

Patent Claims:

1. A sensor for detecting a substance in a liquid,
said sensor comprising a primary substrate and a sensor
5 unit connected to said primary substrate, said primary
substrate being shaped as a pillar, said sensor
comprising detecting means for detecting a change of
stress or mass generated on a surface area of the sensor
unit, and an electric communication line for applying a
10 voltage over said detection means, at least one of said
wires being integrated in said pillar shaped primary
substrate.
- 15 2. A sensor according to claim 1 wherein said
sensor unit is a flexible unit in the form of a
cantilever, such as a cantilever connected to one pillar
shaped substrate, and a cantilever connected to two
pillar shaped substrates e.g. a bridge.
- 20 3. A sensor according to any one of the claims 1
and 2 wherein said sensor unit is a flexible sheet-formed
unit having an average thickness which is less than both
its average length and its average width.
- 25 4. A sensor according to any one of the claims 1-3
wherein said means for detecting a change of stress
generated on a surface area of the sensor unit is in the
form of a surface stress sensing element integrated in
30 the sensor unit, said electric communication line
including a pair of wires for applying an electrical
field over the surface stress sensing element, said
surface stress sensing element preferably being selected
from the group consisting of a piezoelectric element, a

strain gauge, a Si or C nanotube, a capacitor and a piezoresistor.

5. A sensor according to any one of the claims 1-3
5 wherein said means for detecting a change of stress generated on a surface area of the sensor unit is in the form of a laser system.

6. A sensor according to any one of the claims 1-5
10 wherein said pillar shaped primary substrate has an uppermost surface and a lowermost surface and a height defined as the shortest distance between said uppermost and lowermost surfaces, which sensor unit is a flexible sheet-formed unit having two major surfaces, said sensor
15 unit being connected to said primary substrate so that it protrudes from the primary substrate, said upper surface of said sensor unit having an angle to the uppermost surface of said primary substrate between 135° and 225° , said upper surface of said sensor unit preferably being
20 substantially parallel to the uppermost surface of said primary substrate, said uppermost surface of said primary substrate and said upper surface of the sensor unit preferably being in direct prolongation of each other.

25 7. A sensor according to claim 6 wherein said uppermost surface of the primary substrate is substantially plane and said electric communication line passes through the primary substrate in a sum line having an angle of at least 45° or at least 65° , such as about
30 90° to the uppermost surface of the primary substrate.

8. A sensor according to any one of the preceding claims wherein one or both of the wires of said electric communication line pass through the primary substrate and

exit the primary substrate to provide electric communication line exit(s) at the lowermost surface of the primary substrate, said lowermost surface of the primary substrate being connected to a secondary
5 substrate.

9. A sensor according to any one of the preceding claims wherein one or both of the wires of said electric communication line pass through the primary substrate
10 material in a substantially straight line.

10. A sensor according to claim 4 wherein said surface stress sensing element in the form of a piezoresistor or a strain gauge comprises or preferably
15 consists of a material selected from the group consisting of amorph silicon, polysilicon, single crystal silicon, metal or metal containing composition, e.g. gold, AlN, Ag, Cu, Pt and Al conducting polymers, such as, doped octafunctional epoxidized novalac e.g. doped SU-8, and
20 composite materials with an electrically non-conducting matrix and a conducting filler, wherein the filler preferably is selected from the group consisting of amorph silicon, polysilicon, single crystal silicon, metal or metal containing composition, e.g. gold, AlN,
25 Ag, Cu, Pt and Al, semi-conductors, carbon black, carbon fibres, particulate carbon, carbon nanowires, silicon nanowires.

11. A sensor according to claim 4 wherein said
30 capacitor in the form of two conducting elements of e.g. metal or conductive polymers is separated in a distance of up to about 5 μm from each other by a dielectricum selected from the group consisting of liquid, gas or

solids e.g. air, and octafunctional epoxidized novalac e.g. SU-8.

12. A sensor according to any one of the preceding
5 claims wherein said primary substrate comprises one or more of the materials selected from the group consisting of silicon, silicon nitride, silicon oxide, metal, metal oxide, glass and polymer, wherein the group of polymers preferably includes epoxy resin e.g. an octafunctional
10 epoxidized novalac, polystyrene, polyethylene, polyvinylacetate, polyvinylchloride, polyvinylpyrrolidone, polyacrylonitrile, polymethylmetacrylate, polytetrafluoroethylene, polycarbonate, poly-4-methylpentylene, polyester, polypropylene, cellulose,
15 nitrocellulose, starch, polysaccharides, natural rubber, butyl rubber, styrene butadiene rubber and silicon rubber.

13. A sensor according to any one of the preceding
20 claims wherein said sensor unit is based on a material included in the primary substrate, preferably said sensor unit is based on the same material as that of the primary substrate, more preferably said sensor unit being integrated with said primary substrate.

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14. A sensor according to any one of the preceding claims wherein said primary substrate and said secondary substrate are of the same material.

30 15. A sensor according to any one of the preceding claims wherein said cantilever is connected to one pillar shaped primary substrate and protrudes from the primary substrate in one or more cantilever protruding directions to provide a free edge of said cantilever, said

cantilever having a two-dimensional cantilever shape defined as the shape surrounded by the cantilever free edge and the stem line along the connection to the pillar shaped primary substrate, which shape may be regular or
5 irregular, and preferably is selected from the group consisting of square, rectangular, triangular, pentagonal, hexagonal, leaf shaped, circular and oval periphery.

10 16. A sensor according to any one of the claims 1-14 wherein said sensor unit in the form of a cantilever is connected to two pillars shaped primary substrates to thereby form a bridge.

15 17. A sensor according to any one of the claims 15 and 16 wherein said primary substrate has an uppermost surface or said primary substrates have uppermost surfaces, said uppermost substrate surface(s) being substantially parallel with the upper surface of the
20 cantilever when the cantilever is in a non stressed state.

18. A sensor according to any one of the claims 15-17 wherein both of said wires in the pair of wires pass
25 through the primary substrate or substrates in a sum line having an angle which is substantially perpendicular to the uppermost substrate surface(s), the centre line of the pillar shaped primary substrate(s) preferably being perpendicular $\pm 20^\circ$ to uppermost surface thereof, which
30 wires pass through the primary substrate and exit the pillar shaped primary substrate(s) at its lowermost surface.

19. A sensor according to claim 18 wherein said pillar shaped primary substrate(s) is/are connected to a secondary substrate comprising a circuit for applying the voltage, said secondary substrate preferably being an electronic chip comprising contact pads corresponding with said wire exits.

20. A sensor according to any one of the claims 17-19 wherein said pillar shaped primary substrate(s) is/are connected to two or more cantilevers, the wires of which cantilevers pass through the pillar shaped primary substrate(s), said cantilevers preferably having a two-dimensional cantilever shape which is substantially identical to each other, more preferably said two-dimensional cantilever shape preferably being selected from the group consisting of square, rectangular, triangular, pentagonal, hexagonal and leaf shaped periphery.

21. A sensor according to any one of the preceding claims further comprising a secondary substrate supporting said pillar shaped primary substrate or substrates, said secondary substrate comprising an electric supply line for supplying an electric field over the respective pair(s) of wires, said wires preferably being guided through the secondary substrate.

22. A sensor according to claim 21 wherein said secondary substrate is an electronic chip comprising contact pads corresponding with said wire exits.

23. A sensor according to any one of the claims 21-22 wherein said secondary substrate carries an array of pillar shaped primary substrates carrying sensor units

connected thereto, wherein the wires are incorporated in the primary substrates.

24. A sensor according to any one of the preceding
5 claims wherein said sensor comprises a secondary
substrate and a plurality of pillar shaped primary
substrates, each of said pillar shaped primary substrates
having an uppermost surface and a lowermost surface, and
a pillar wall surface, said pillar shaped primary
10 substrates being connected to said secondary substrate at
its lowermost surface, said sensor comprising a liquid
chamber capable of containing a liquid so that liquid can
be applied in said liquid chamber to surround one or
more, preferably all of said pillar shaped primary
15 substrates so that the pillar wall extending around said
pillar shaped substrate and at least a part of the sensor
unit connected to the pillar shaped substrates are
contacted with the liquid.

20 25. A sensor according to any one of the preceding
claims wherein said sensor further comprises a fluid
channel, said sensor units partly or totally being
disposed in said fluid channel, said pillar shaped
primary substrates preferably being disposed in said
25 fluid channel.

26. A sensor according to any one of the preceding
claims wherein said sensor comprises at least one sensor
unit having a target surface area, which area has been
30 functionalised by linking of one or more functional
groups comprising a detection ligand to said target
surface area, said detection ligand being a member of a
specific binding pair.

27. A sensor according to any one of the preceding claims wherein the sensor comprises at least two sensor units, at least one of said sensor units being a reference unit.

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28. A sensor according to claim 27 wherein said reference unit comprises a target surface area, which area has a surface chemistry different from the sensor unit for which the reference unit acts as reference, preferably said target surface area has been functionalised by linking of one or more functional groups, wherein said one or more functional groups linked to the surface area of said reference unit or its concentration are different from the sensor unit for which the reference unit acts as reference.

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